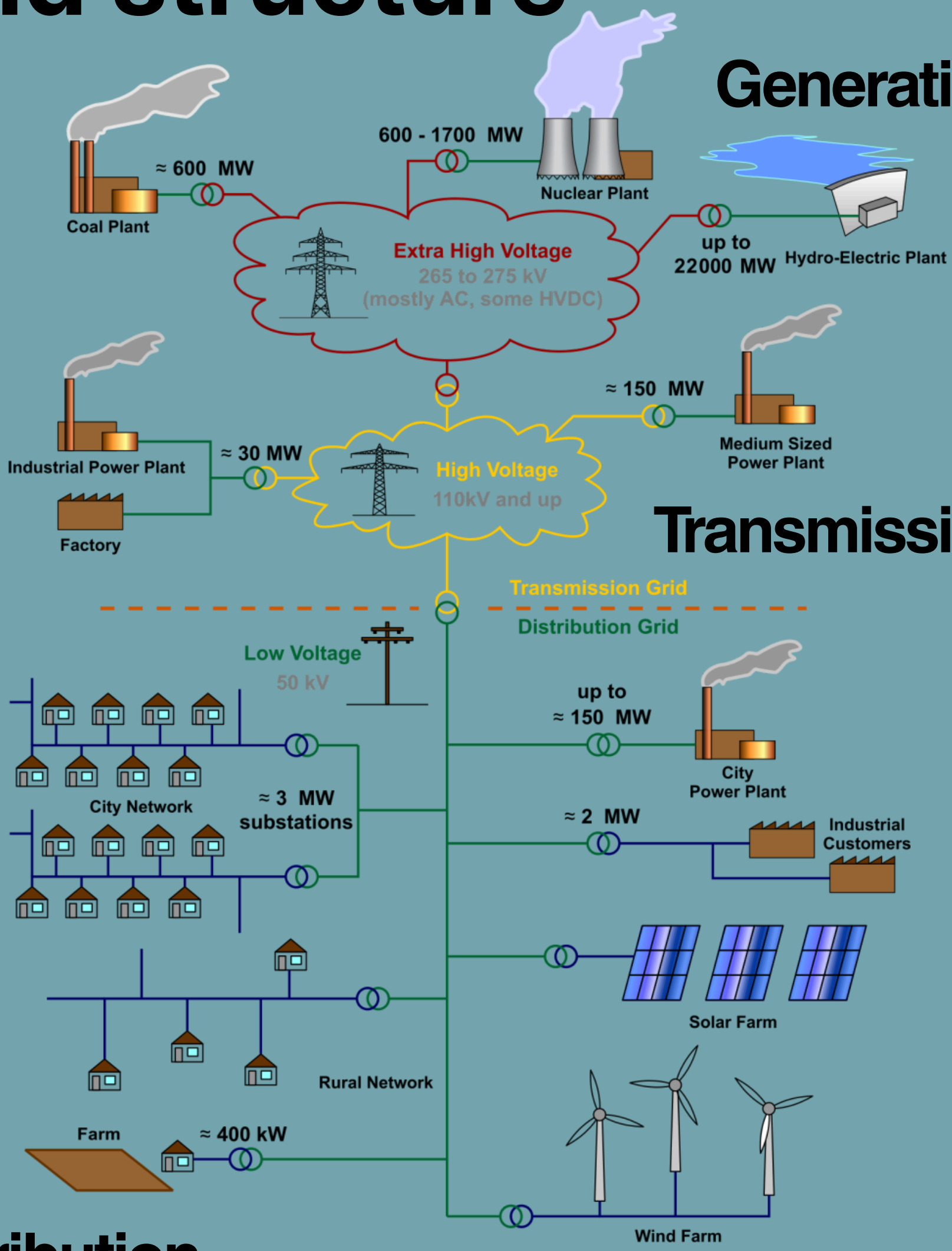
Why is the US electric grid so confusing?

A fast way to learn about the clean energy transition is to learn about electricity.

A well-supported decarbonization strategy is to electrify everything (industry, transportation, and heating) and produce only emission-free electricity.

The electrical grid underpins this transition.

Grid structure



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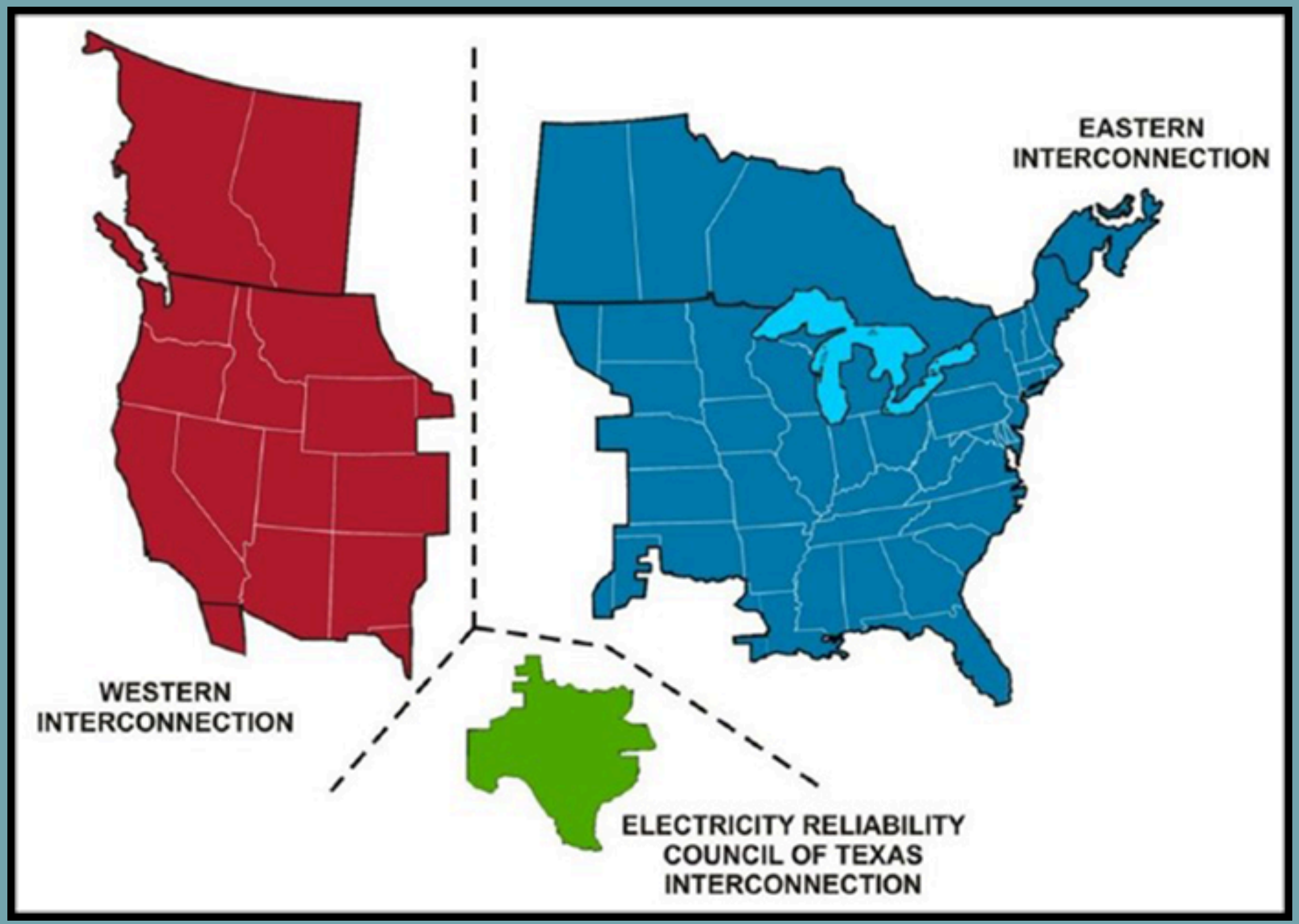
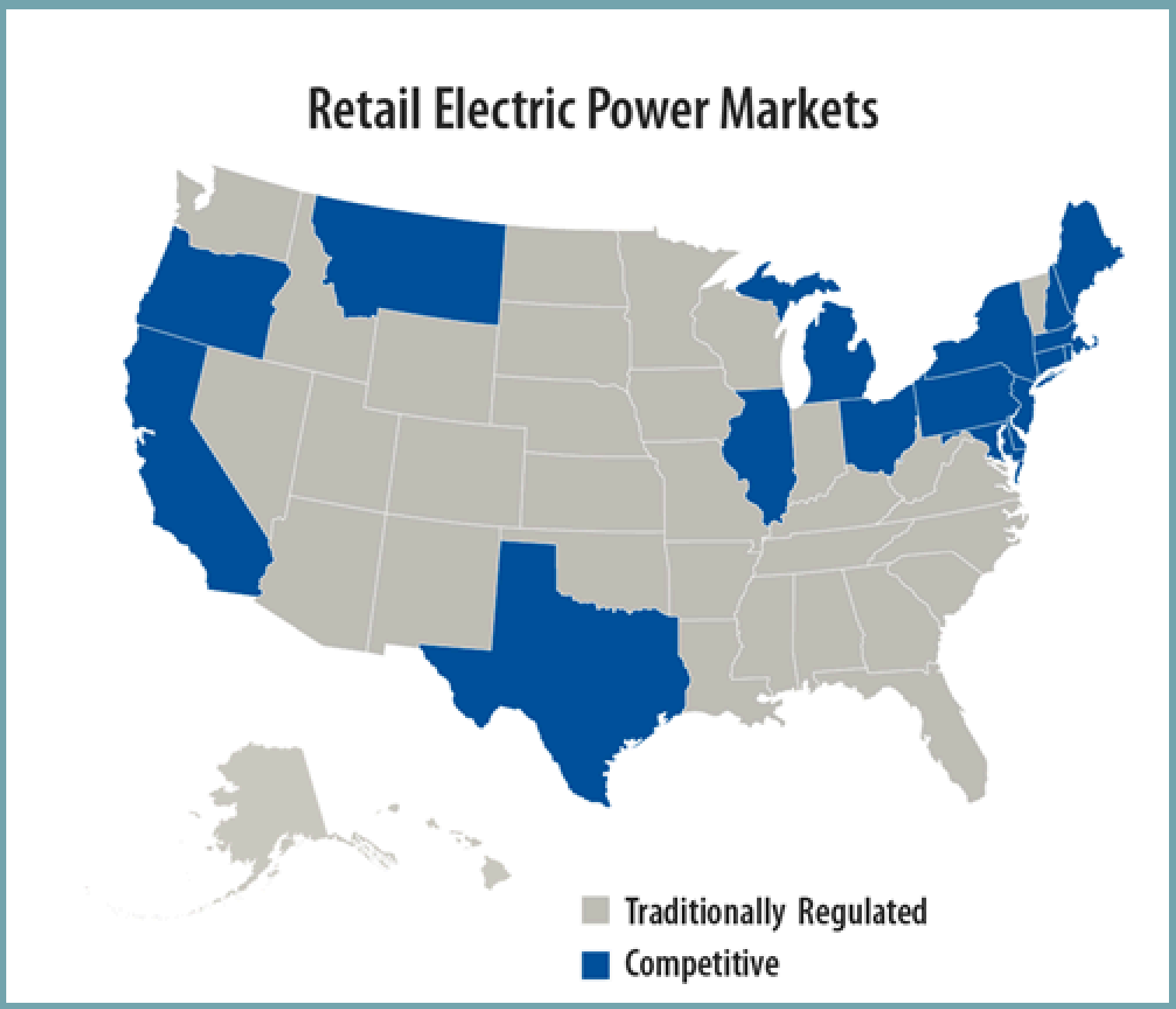
Power is generated by electricity generators, transmitted over long distances, and then distributed locally.



Across North America, 3 separate grids provide and share electricity across their regions. Curious about Texas?

Texas sought to avoid federal regulation and oversight and thus kept its grid within state lines. The Electric Reliability Council of Texas (ERCOT) is an example of a **deregulated retail electricity market.**

Regulated vs Deregulated (or competitive) markets



Electric utilities are for-profit companies that oversee the electricity services provided to customers.

In **a regulated market,** electric utilities are vertically integrated monopolies that can own and operate generation, transmission, and distribution.

In **a deregulated market,** electric utilities buy electricity from wholesale markets and only own and operate distribution networks.

EPA.GOV Understanding electricity markets

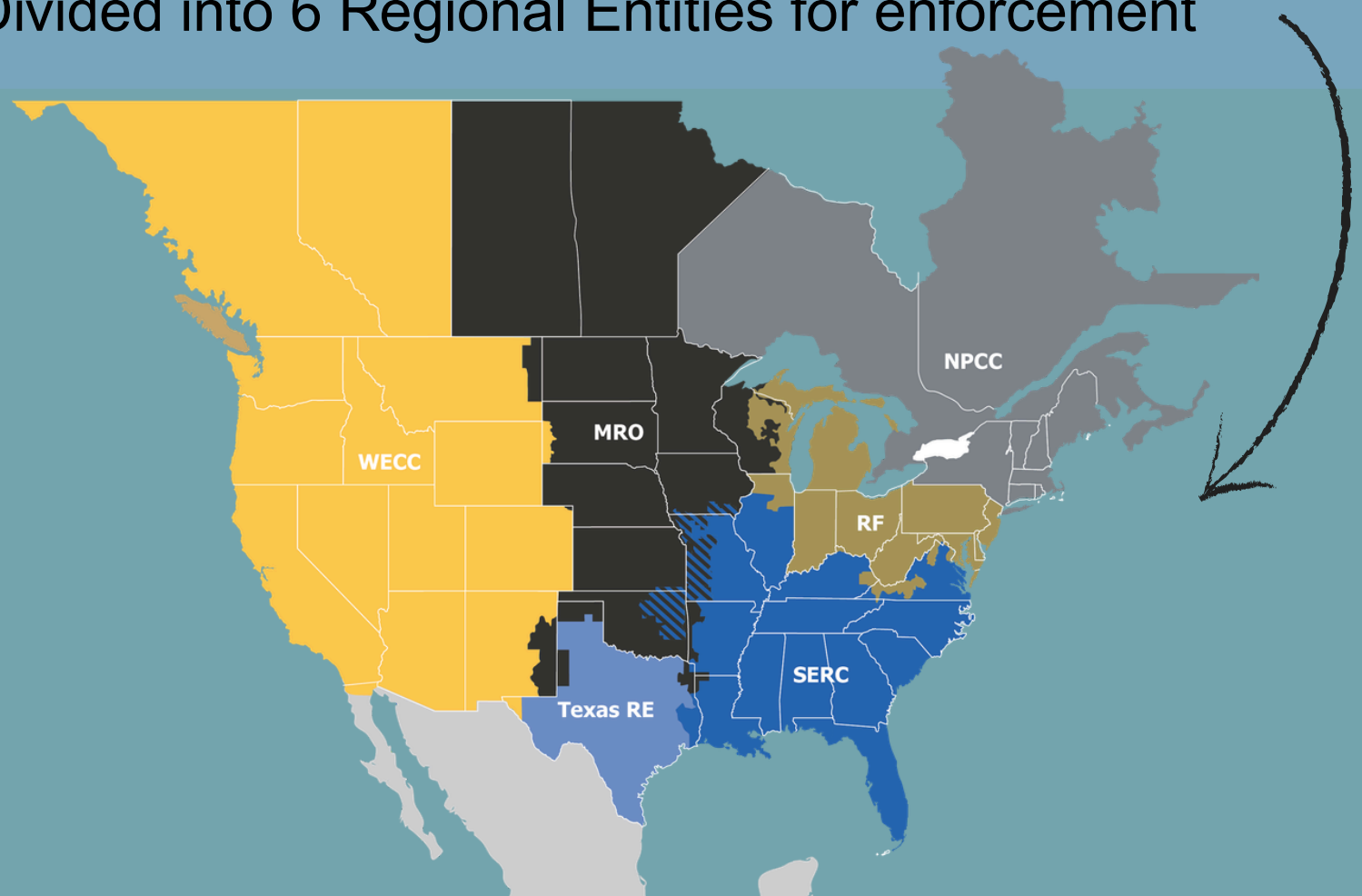
Some things about the electric grid are federally regulated, and a lot of things aren't.

FERC *FEDERAL ENERGY REGULATORY COMMISSION*

- Oversees the bulk transmission of electricity around the country across state lines.
- Sets and enforces wholesale electricity market rules and rates.

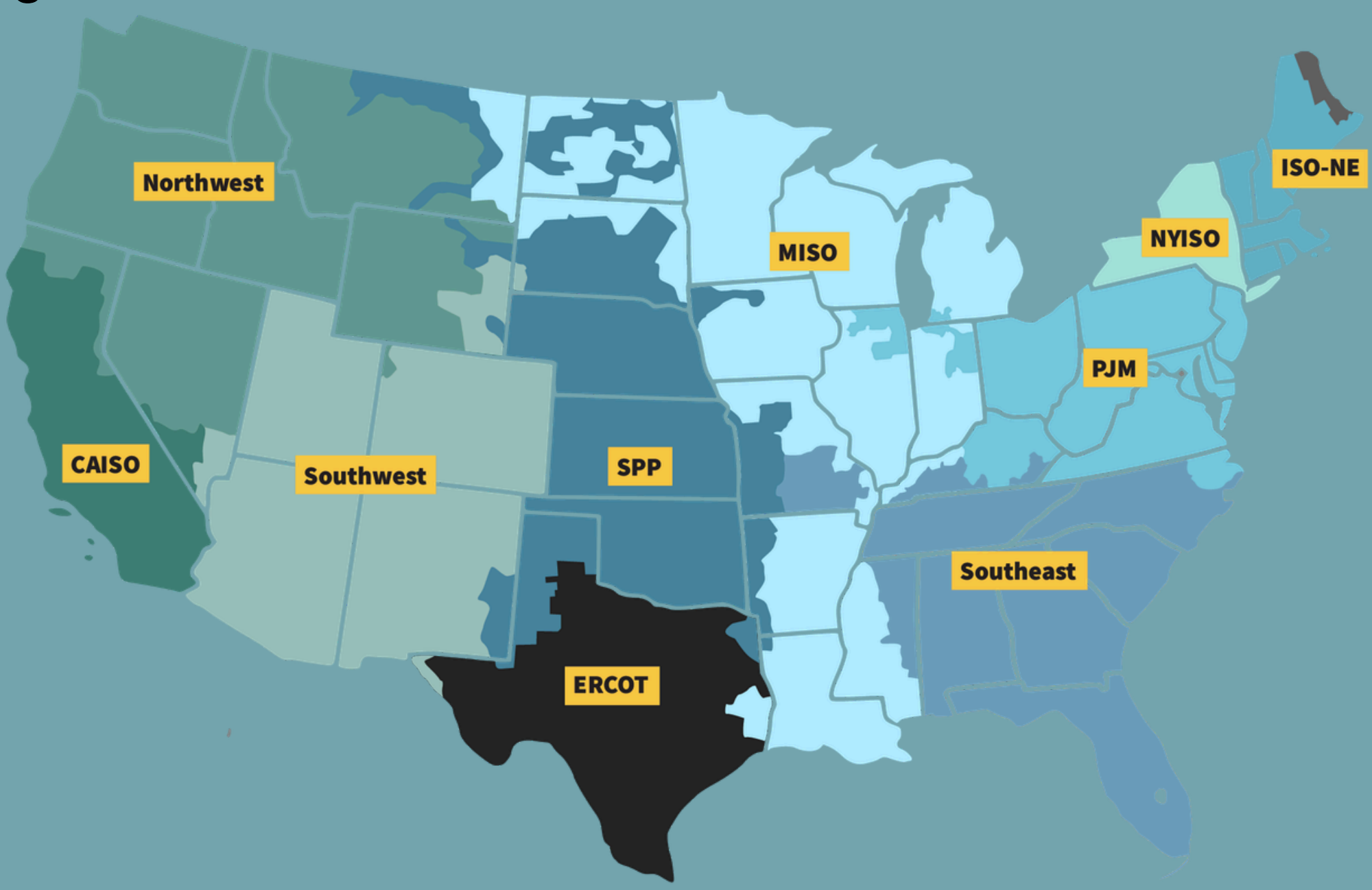
NERC *NATIONAL ELECTRICITY RELIABILITY CORP*

- Develops and enforces mandatory grid safety and reliability standards
- Divided into 6 Regional Entities for enforcement



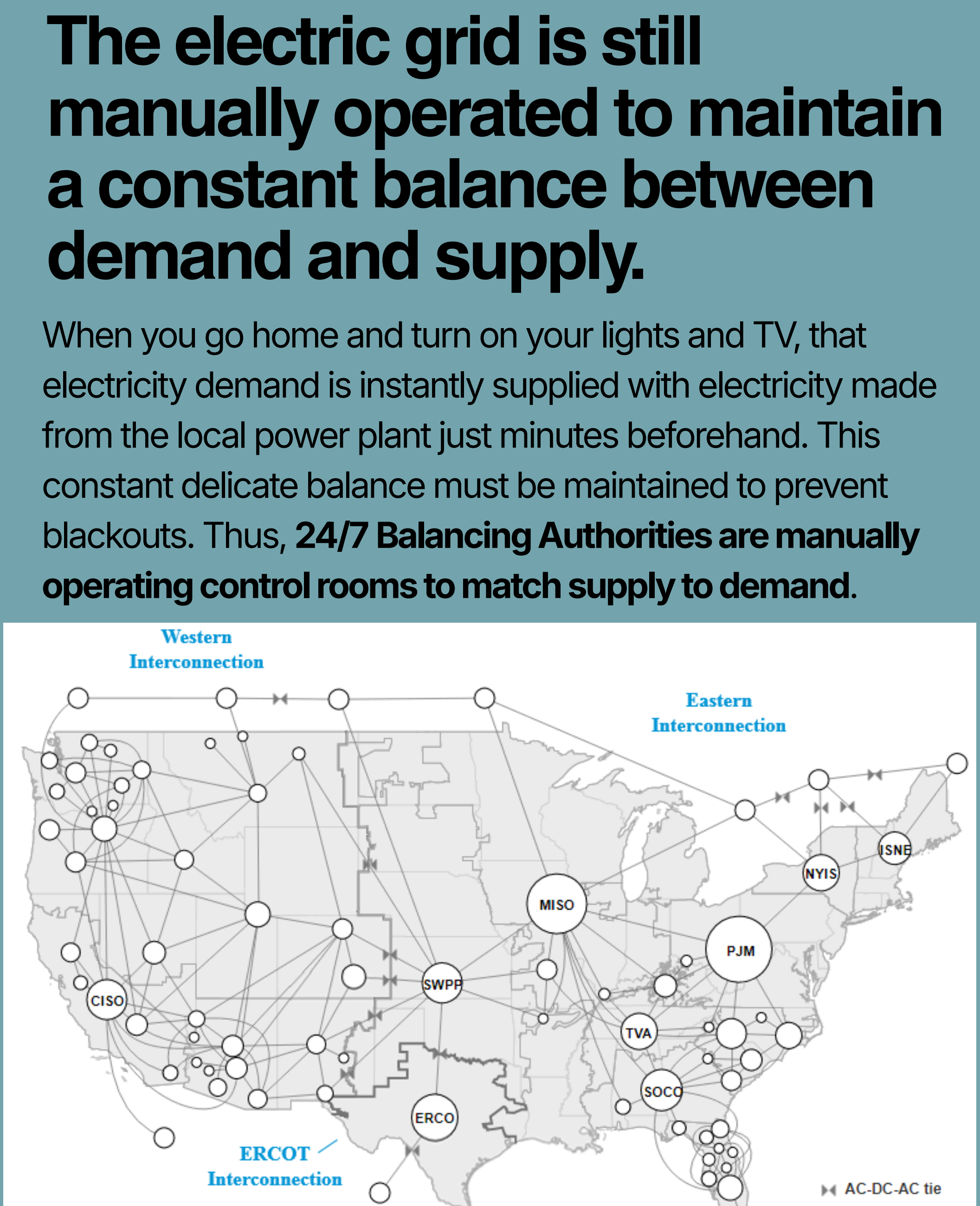
Every day, there is a wholesale electricity market auction.

Wholesale electricity markets are auctions where power generators go to sell electricity to utilities, retailers, and large consumers. Each of the regional entities (ISOs/RTOs) on the map below operates these auctions. **Independent system operators (ISOs) and Regional Transmission Organizations (RTOs)** coordinate generation and transmission flows.



The electric grid is still manually operated to maintain a constant balance between demand and supply.

When you go home and turn on your lights and TV, that electricity demand is instantly supplied with electricity made from the local power plant just minutes beforehand. This constant delicate balance must be maintained to prevent blackouts. Thus, **24/7 Balancing Authorities are manually operating control rooms to match supply to demand.**

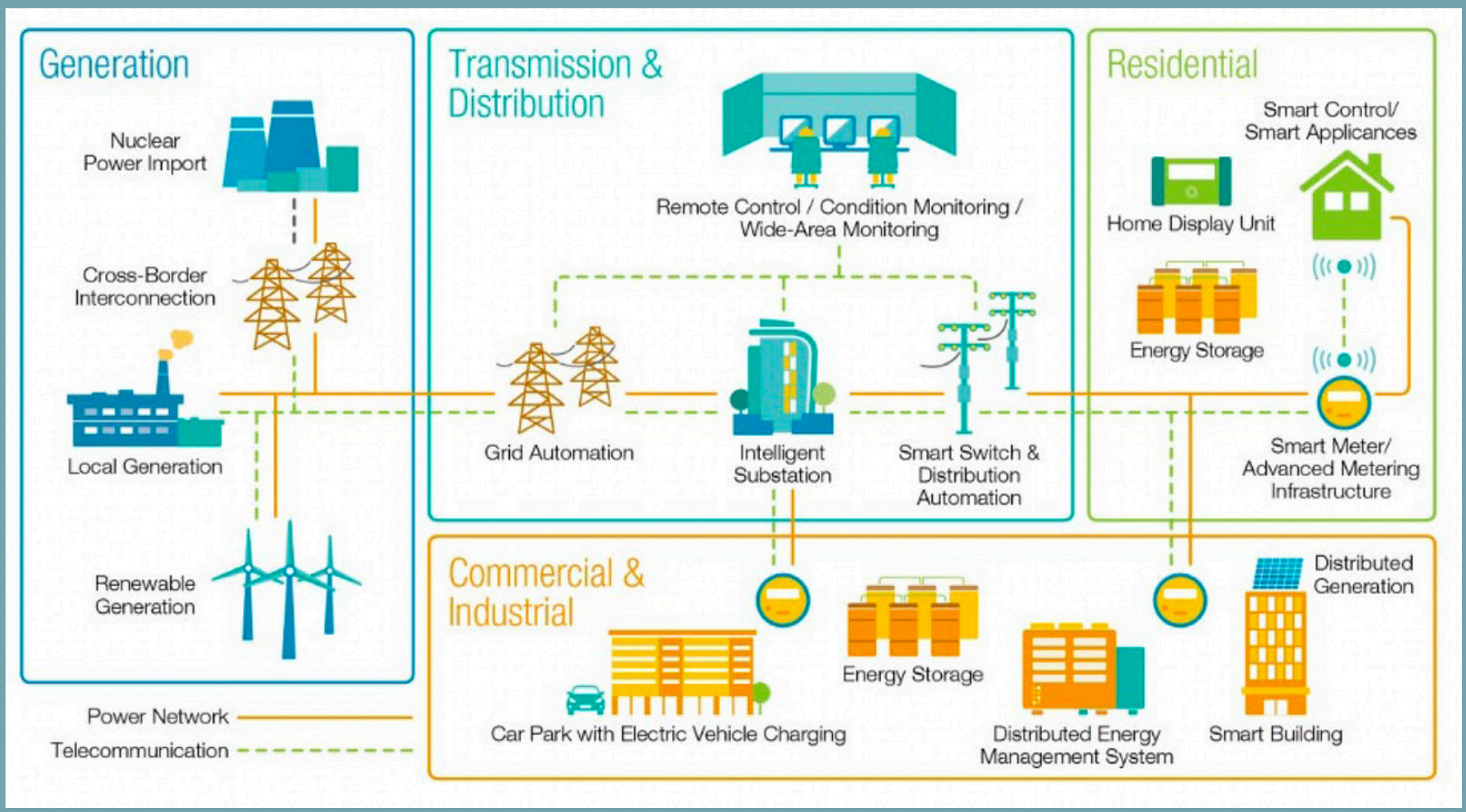


The future of the US electrical grid is uncertain

The forecasted electricity demand from data centers and increased heating, transportation, and industrial electrification is creating an urgent need for additional electricity supply.

Clean strategies for meeting this uncertain demand include:

- **Solar/wind + battery storage.** Charge batteries during peak supply hours and use the stored energy during peak demand. It can be implemented on both small and large scales.
- **Smarter grid utilization methods.** Connecting and digitalizing the distributed electricity supply, storage, and demand technologies to transfer electricity more efficiently around the current grid.



U.S. Department of Energy, Smart Grid System Report (2022)

Where and how to learn more about electricity

Keep learning about the clean energy transition and the current or impending changes to your electric bill here:

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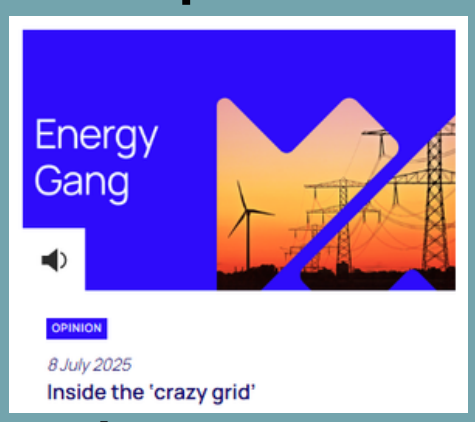

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